3/24/87

IN REPLY REFER TO:

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
SALT LAKE DISTRICT OFFICE
2370 South 2300 West
Salt Lake City, Utah 84119

2800 (U-020)

2 or 3 - ft level

March 13, 1987

Ladies and Gentlemen:

Enclosed is a copy of the Draft Environmental Assessment (EA) for Amax Magnesium Corporation's proposal to build and maintain an evaporative pond system near Knolls in Tooele County.

I encourage you to review the draft EA and submit your comments on the analysis by April 14, 1987, to:

Howard Hedrick
Pony Express Resource Area Manager
Bureau of Land Management
2370 South 2300 West
Salt Lake City, Utah 84119

Your interest in the management of public lands is appreciated.

Sincerely yours,

Howard Hedrick

Howard Hedrick
Pony Express Resource Area Manager

Enclosure
Draft EA

000001

Knolls Solar Evaporation Pond System

ENVIRONMENTAL ASSESSMENT

Draft

Submitted to

Bureau of Land Management
Salt Lake District Office
2370 South 2300 West
Salt Lake City, UT 84119

Prepared by

BIO/WEST, Inc.
1063 West 1400 North
Logan, UT 84321

March 13, 1987

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Introduction

In accordance with the National Environmental Policy Act of 1969 (Public Law 91-190, 1970), the Bureau of Land Management (BLM) has prepared this environmental assessment (EA) in response to the filing of a right-of-way application by AMAX Magnesium Corporation (AMAX) pursuant to Section 501 of the Federal Land Policy and Management Act of 1976 (43 USC 1761; 90 Stat. 2776). AMAX has requested use of approximately 54,000 acres of public lands near Knolls, Utah, for development of the Knolls Solar Evaporation Pond System designed to produce brines for magnesium extraction at their existing plant in Rowley, Utah (Figure 1). The ponds would be located in the west desert, adjacent to a 320,000 acre lake (West Pond) which will be created by the West Desert Pumping Project (USDI 1986). A pipeline across public lands would connect the pond system to the AMAX magnesium plant.

This chapter explains the purpose and need for the project, and describes the proposed project, alternatives and the scoping process that was conducted for this EA.

Purpose and Need

Industries have harvested salts and other minerals by evaporation from the brines of the Great Salt Lake for many years. These industries, locally referred to as evaporative industries, are an important component of the Utah economy, especially on a local and county basis. The standard procedure is to pump or channel lake brine into shallow areas, creating ponds. The high surface to volume ratio of these ponds in combination with a dry sunny climate creates optimal conditions for rapid evaporation of water. As water evaporates, the concentration of minerals increases in the brine contained in these ponds. Evaporative industries process this highly concentrated brine to obtain minerals such as magnesium or mine the salts that precipitate out of solution after the saturation point has been reached.

As the Great Salt Lake rose rapidly during the early 1980's, the surface brines became fresher, creating problems for the evaporative industries by increasing the evaporation needed to gain the desired brine concentration. In addition, the rising lake encroached upon the low lying solar ponds of many companies, thereby putting some firms out of business; others raised the height and size of their dikes in an attempt to maintain their ponds.

AMAX, one of the largest evaporative companies, maintained about 43,000 acres of solar ponds in the Stansbury Basin in the southwestern portion of the lake bed (Figure 1). The ponds were protected by the North Dike, a dike built by AMAX from dredged lake bed materials. The surface elevation of the ponds was, initially, higher than the level of the Great Salt Lake. As the lake continued to rise, the elevation of the lake rose above the level of the ponds. When the lake reached a new historic high level of nearly 4212 feet in early June of 1986, the difference in elevation between the lake and AMAX's ponds was nearly 7 feet. On June 7, 1986, the North Dike was breached during a strong wind storm. The resultant flow of water reduced the level of the Great Salt Lake by approximately 6 inches which benefited lakeshore properties, but destroyed all of AMAX's ponds.

The loss of the ponds essentially eliminated the source of brine for processing at the AMAX magnesium plant. The proposed Knolls Solar Evaporation Pond System (KSEPS) would supply the plant with the needed brine. Therefore, the purpose of this project is to provide brines for the existing AMAX plant and the need and justification of this project is manifested by the role AMAX plays in the local and state economy.

Proposed Action and Alternatives

Proposed Action—Knolls Solar Evaporation Pond System

The proposed KSEPS would obtain brine from the West Pond created by the West Desert Pumping Project (WDPP), concentrate the brine through a series of evaporation and finishing ponds until a 7-9% magnesium solution was obtained, and transport the concentrated brine for processing at Rowley, Utah. The WDPP is being constructed to reduce the level of the Great Salt Lake by pumping water from the lake into an evaporation pond (West Pond) in the west desert. Water will evaporate out of West Pond and produce a concentrated brine solution that will flow back to the lake. The WDPP is designed in a manner that would circulate the brine and keep evaporites in solution and available to the KSEPS. This brine would have a higher mineral concentration than Great Salt Lake brine and would, therefore, require less evaporation to provide brines for magnesium extraction.

Once pumping has begun, the KSEPS would begin operations by drawing brine from a 4215 foot depression in West Pond with a dredged canal and circulating this brine through a series of evaporation ponds. This period of operations occurring in synchrony with the WDPP is termed the steady-state scenario. However, the WDPP will continue only until the Great Salt Lake reaches a level of 4208 feet, as stipulated in the right-of-way permit granted by the U.S. Air Force. When this event occurs, a second, or post-pumping, scenario would begin for the KSEPS. This scenario would involve filling the evaporation ponds to their maximum potential with evaporation and processing occurring during the period when brine was no longer available from the West Pond.

The components, construction, and operation of the KSEPS under the steady-state and post-pumping scenarios are described below and depicted in Figure 2.

1. Steady-state Scenario

a. Project Components

The KSEPS would consist of an inlet canal, seven evaporation ponds, one storage-evaporation pond (Pond 0), three canals, four pumps, a reservoir, and a pipeline (Figure 2). These components are described below as they would occur at the commencement of operation.

Inlet Canal. The Knolls inlet canal would extend 7.1 miles from the West Pond to the P1 pump station. This canal would be 100 feet wide and 9-10 feet deep and slope downwards from the West Pond to provide gravitational flow. The potential flow through the canal would be 200,000 gpm, but the operation would only require a maximum flow of 150,000 gpm.

Evaporation Ponds. Seven evaporation ponds would be constructed at the beginning of the project. Ponds 1, 2, 3 and 4 would be used for the primary evaporation of water. Ponds 7A, 7B, 7C, and 7D would serve as finishing ponds where brine would be further concentrated and prepared for processing.

Pond 1 would have a surface elevation of 4222 feet and surface area of 4590 acres. Brine depth would average between 4 and 5 feet. A dike would be constructed on the southern (Pond 1 South and Northwest dikes) boundary of the pond. A small separation dike would be constructed between Ponds 1 and 2. The dike would be equipped with a gate to create a higher head between the ponds. The dunes which form a natural boundary on the pond's west side would have to be pushed up in order to contain the brine.

Ponds 2, 3, and 4 would essentially be one large pond separated into three components by elevation and natural contours. No dikes would be constructed between each pond, enabling brine to flow by gravity. The surface area for all three ponds combined would be 6780 acres. Brine depth would vary from 3-5 feet with an average surface elevation of 4222 feet. Pond 2 would be would be contained by natural contours. A dike would be built on the northern boundary of Pond 3 (Pond 3 North Dike). Pond 4 would be enclosed by natural contours.

Pond 7A would have an average depth of 9-12 inches and a surface area of 1450 acres. Dikes would enclose the pond on the north (Pond 7 North Dike), west (Pond 7A West Dike), and a portion of the southern border (7A South Dike); natural contours would form the remaining boundaries. Ponds 7B, 7C and 7D would be bounded by dikes on all sides (see Figure 2). Pond 7B would have an average brine depth of 9-12 inches and a surface area of 850 acres. Pond 7C would have an average brine depth of 9-10 inches and a surface area of 640 acres. Pond 7D would have an average brine depth of 4-6 inches and a surface area of 960 acres. Pond 7D would have internal dikes to facilitate circulation. The surface elevations of Ponds 7A, 7B, 7C, and 7D would be approximately 4223, 4222, 4222, and 4221 feet, respectively, at the start of operations.

After a period of time, salts would precipitate from the brine solution and build up on the bottom of the ponds, primarily in the Pond 7 series. In order to improve operation and maintain brine capacity, salts would be pushed up to form internal dikes.

<u>Pond 0</u>. Pond 0 would be located west of the evaporation ponds. It would be bordered on the east by natural contours and dikes forming the western borders of Pond 1 and 2. New dikes constructed to enclose the pond would

consist of a dike that would run parallel to the inlet canal and then northward (Pond 0 West Dike) and a dike that would be constructed across the northern boundary of the pond, tying into the Pond 3 North Dike. Pond 0 would have a surface area of 10,000 acres and an average brine depth of 3-5 feet. The surface elevation of ~~the pond~~ would be 4220 feet.

Canals. Three small canals would be built for the KSEPS. The P2 feed canal, located on the western border of Pond 7D, would be 60 feet wide and 9400 feet long with a bottom elevation of 4218 feet. The 7A inlet canal, located along the southern edge of the Pond 7 series, would be 15,500 feet long and have a width of 60 feet for the first 14,700 feet with the remainder (800 feet) being 120 feet wide. The bottom elevation of this canal would be 4223 feet. Both of these canals would have a capacity of 60,000 gpm. A small canal would be built between Ponds 1 and 2.

Pump stations. Four pump stations would be installed for use in the KSEPS. Pumps would be run by direct drive diesel. The P1 pump station, with a 200,000 gpm capacity, would be located at the southern terminus of the inlet canal. It would pump water from the inlet canal to Pond 1. The P2 pump station would be located between the P2 and 7A canals and would pump water from Pond 4 to Pond 7A at a maximum flow of 60,000 gpm. The P3 pump station would pump brine at a rate of 12,000 gpm from Pond 7D into the reservoir. The P4 pump station would consist of a pump in each of the four sections of the reservoir and allow intra-reservoir pumping to facilitate certain operations required during the final steps of brine concentration. This pump station would also serve the brine transfer system.

Reservoir. A 767 acre foot reservoir would be located between Pond 7D and Pond 1. The reservoir would be divided into four sections to facilitate the periodic removal of salts.

Pipeline. The proposed brine transfer pipeline consists of approximately 41 miles of 10 inch carbon steel pipe (Figure 1). The pipeline would be buried approximately three feet below the existing site grade. The first 2.0 miles of the pipeline would travel from the reservoir to the Knolls interchange and be placed just north of the Interstate 80 (I-80) right-of-way. Installation is anticipated to be just north of the frontage road which runs parallel to I-80 along most of the section from the Knolls to the Delle interchange, approximately 29 miles. From the Delle interchange, the pipeline would head in a northeast direction for approximately 3.3 miles until it intersects the existing access road to the AMAX magnesium plant at Rowley, Utah. At this point, the pipeline would be constructed parallel to this access road and run into the plant's holding ponds.

Associated Facilities. A variety of facilities would be constructed for use during operation and maintenance of the KSEPS. These include: a maintenance and office building, parking lots, on-site power facilities serving the four pump stations, and a 6.1 acre foot flush water reservoir with a well and pump system.

Approximately 6.3 miles of new road and 4.4 miles of existing road would be improved for use during the KSEPS. These roads would be needed to access some of the dikes and the borrow areas.

b. Project Operation

Brine would be obtained from a 4215 foot elevation depression in the West Pond and flow through the Knolls Pond inlet canal to the P1 pump station. Brine would be pumped into Pond 0 and allowed to evaporate for later use. Brine would be also be pumped at the P1 pump station into Pond 1 and flow into Pond 2 would be regulated by the separation dike. Brine would then flow into Pond 3 and subsequently into Pond 4. The P2 and 7A canals would transport brine from Pond 4 to Pond 7A. Brine would be lifted from the P2 feed canal to the 7A inlet canal with the P2 pump. Brine would then flow through a series of gates from Pond 7A to Pond 7B to Pond 7C and into Pond 7D. Brine from Pond 7D would be pumped by the P3 pump station into the reservoir. Brine would then be transported through a pipeline to the AMAX magnesium plant at Rowley, Utah.

Pond 0 would primarily be used as a storage pond with batch type introduction of brine into the system when the concentration of brine in Pond 0 is higher than the brine concentration in the West Pond. It would initially be filled to about 3 feet deep and allowed to evaporate so that the brine concentration increases. At periods of the year when the brine in Pond 0 is more concentrated than in the West Pond, brine would be pumped from Pond 0 via the P1 pump station into Pond 1 and processed through the system.

2. Post-pumping Scenario

a. Project Components

The same components utilized in the steady-state scenario would also be utilized in the post-pumping scenario with the addition of a storage pond, Pond 5. This pond would be contained by natural contours, a dike along its northern boundary (Pond 5 North Dike), and the 7 North Dike on its southern end. A gate in the 7 North Dike would control the flow of brine into the pond. Pond 5 would have a surface area of 1499 acres and a brine depth of 8 feet. The pond would be filled to an elevation of 4236.

Pond 0 would serve as an evaporation and storage pond in the post-pumping scenario. The Pond 0 North Dike would be raised to 4230 feet to allow for a brine depth of approximately 10 feet in Pond O. All other evaporation ponds would be filled to capacity (approximately 8 feet deep). Temporary pumps and canals would be used at the termination of post-pumping operations to drain all ponds.

b. Project Operation

When West Desert pumping ceases, the operational objective of the KSEPS would be to store as much brine as possible. At the outset of the post-pumping scenario, withdrawals from the West Pond would be made to fill all ponds to maximum depths. The ponds would then be operated from optimal water evaporation by systematically drying out different ponds and moving the resultant high grade brine to deeper, longer term storage ponds (Pond 5, Pond 7D, and the reservoir). Once brine was no longer available from West Pond, brine would be processed through the KSEPS. The initial evaporation rates would be 33.5 inches per year, fresh lake water net evaporation, on the brines from the West Pond. However, since evaporation rates are inversely related to brine concentration, the rate would reduce to about 5-6 inches per year with the 8% finished harvest brine. Thus, as the high grade brines are moved into deeper storage ponds (depths of 4 feet or greater), the evaporation per unit volume diminishes significantly. Even so, groundwater, obtained from the Rowley plant site via the 41 mile pipeline, would be used to cover the finished brine to counter the net evaporation and prevent losses of the product from crystallization.

Under this scenario, enough brine would be generated to keep the KSEPS operating for approximately 5 years after the announced shut down of the WDPP. However, enough brine would be generated to keep the AMAX magnesium plant in full operation for about 12-15 years.

3. Construction

Although the final project design has not been completed, it is anticipated that three types of dikes would be constructed for the KSEPS. Changes in dike design and borrow material may change at the discretion of the contractor. Dikes built solely for use as containment structures would be built from cast up silts and clays from the pond bottoms and then armored with imported fill after the first year of completion (Figure 3). Dikes which would provide brine containment and also have an access road constructed on their crest would be constructed with a dune sand core overtopped with imported fill (Figure 4). Dikes constructed for the 767 acre foot reservoir would be built entirely from imported fill (Figure 4) which would better absorb any dike settlement and provide access to the reservoir.

Draglines would be used to excavate materials and for construction of dikes created by casting up silty and clayey soils. Dune sand and imported fill dikes would be constructed by end dumping material from trucks and progressively extending the dike until the necessary length is reached. Modification of natural contours along the western side of the KSEPS to produce saddle dikes would involve pushing up sand from existing dunes using dozer tractors.

Access roads to the KSEPS would have 2.5:1 sideslopes and be composed of four feet of imported fill (Figure 3). Pumps and power generation equipment would be placed on pile foundations. Buildings would be placed on spread footings made of structural fill pads at least 2 feet thick. Canals would be constructed either with backhoes and draglines or by blasting with explosives.

Three types of borrow would be needed for construction of the KSEPS: lakebed sediments (silts and clays), dune sand, and imported fill. A total of

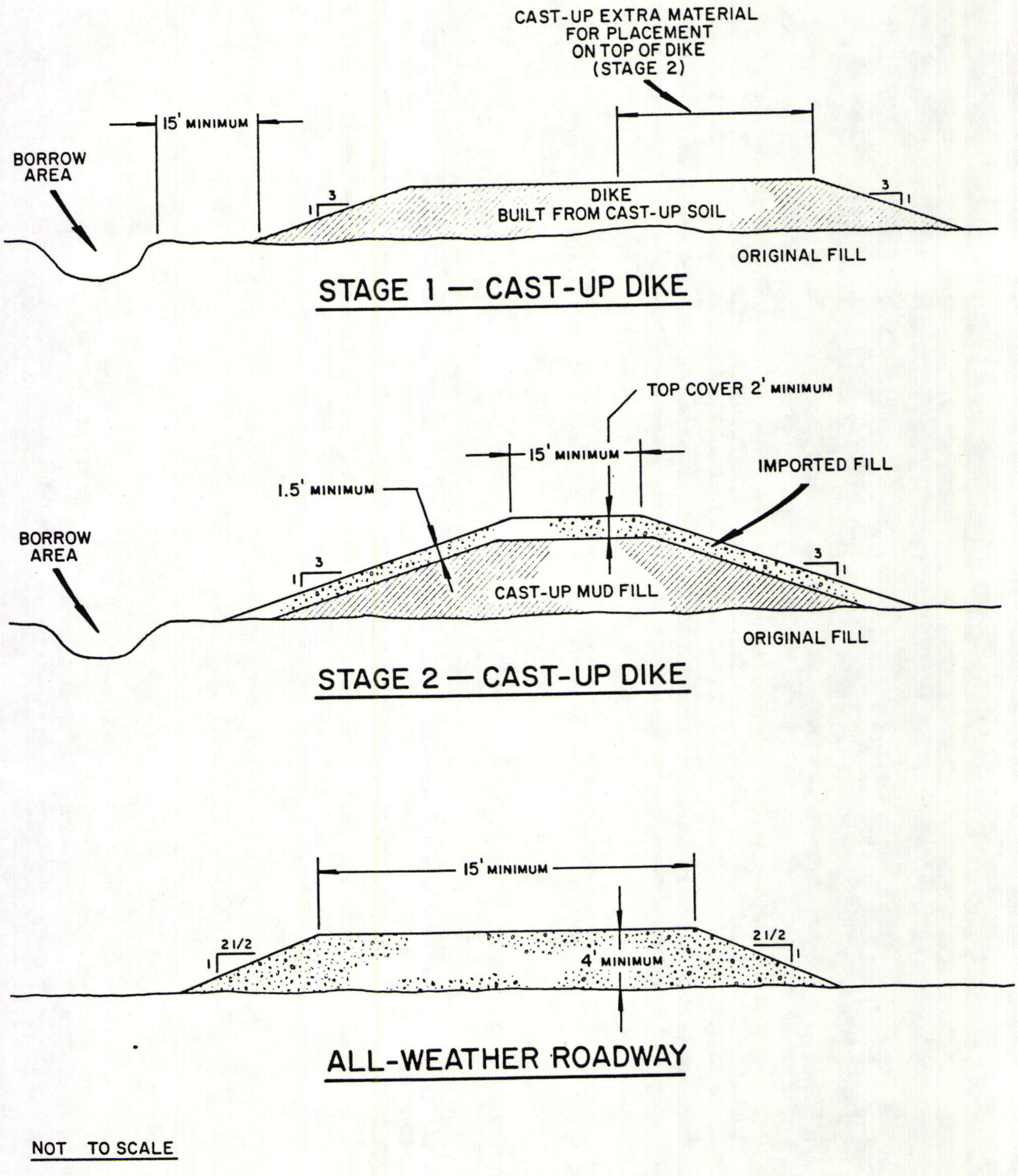
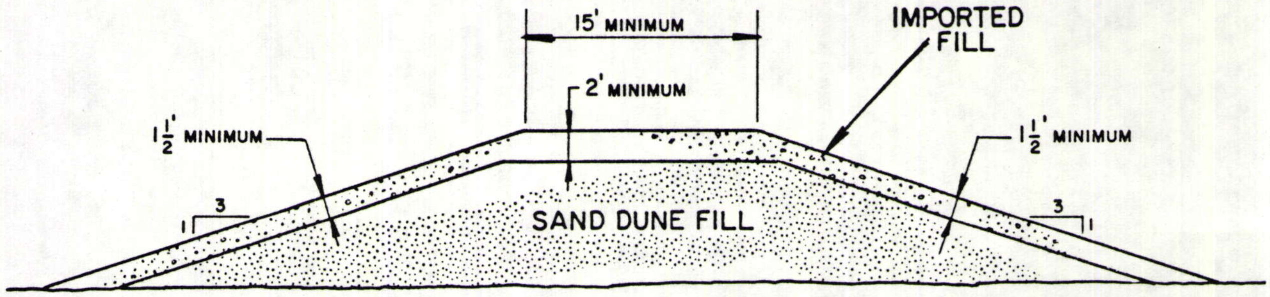


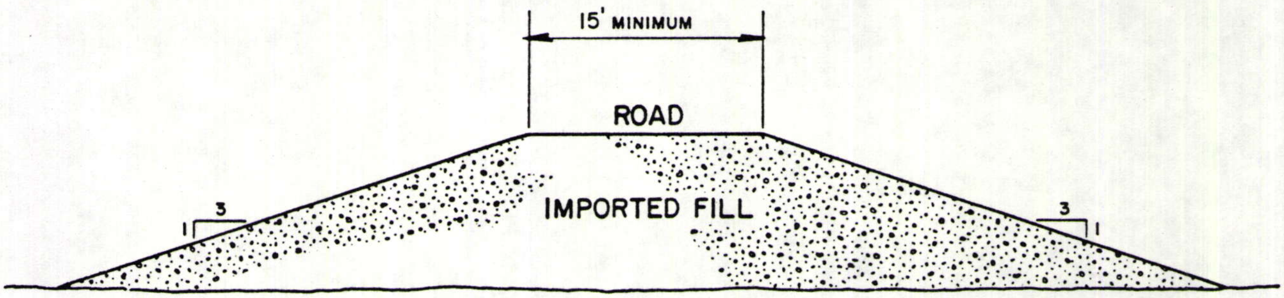
FIGURE 3.

TYPICAL DIKE CONSTRUCTION

Dames & Moore



SAND DUNE FILL DIKE



IMPORTED FILL DIKE

NOT TO SCALE

FIGURE 4.

TYPICAL DIKE CONSTRUCTION

Dames & Moore

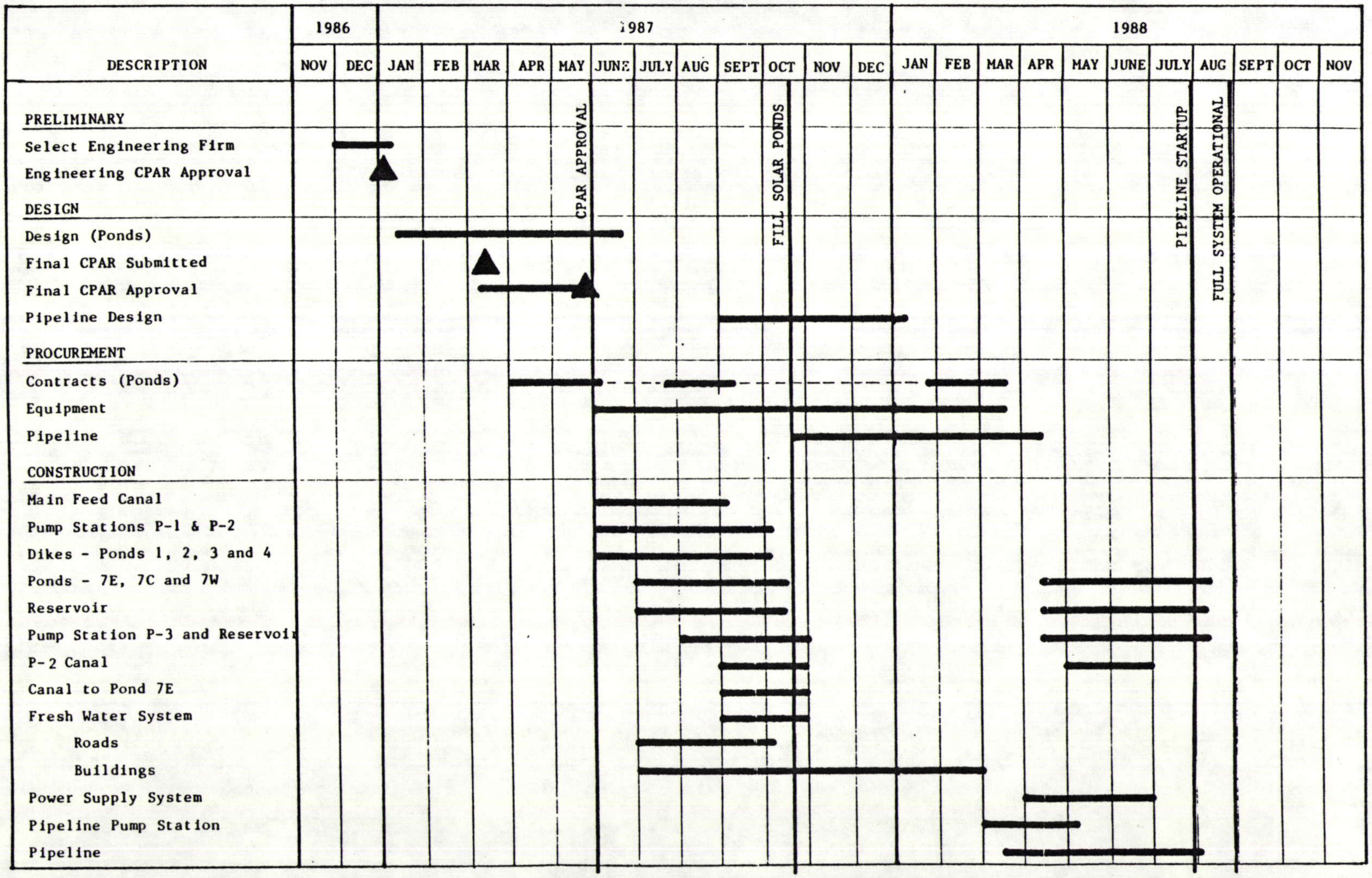
3,150,000 cubic yards of silts and clays would be obtained from the lakebed sediments which comprise the bottom of the evaporation ponds. Dune sand would be obtained from the sand dunes which are located on the project site. A total of 785,000 cubic yards of this material would be required, with 585,000 cubic yards being used for cast up construction of dikes, and 200,000 cubic yards required for the saddle dikes that would close gaps in the sand dunes and create a dike.

Granular borrow would be obtained from sites on the Grayback Hills (Figure 5). The south pit on the Grayback Hills (Borrow Site 4) would be the source of approximately 1,300,000 cubic yards of granular material needed during project construction. An additional 950,000 cubic yards of granular material will obtained from one of three potential sites (Borrow Sites 1, 2, 3) located on the northern end of the Grayback Hills. Mining operations at Borrow Site 1 could not commence until the Air Force determined whether a clearance for ordnance was required and the proper clearance measures were taken, if deemed necessary. Borrow sites 1 and 3 are on BLM lands, while site 2 is within a State school section. Approximately 400 acres would be disturbed to obtain the 2,250,000 cubic yards of granular borrow needed for the project.

In order to achieve the maximum benefit from the KSEPS, the evaporation ponds must be filled by October 1987. To reach this goal, the inlet canal, Ponds 1, 2, 3, and 4, the P1 pump station, and the 7A North Dike must be completed in the summer of 1987. The first brine would then be harvested in August 1988, at which time the remaining pond facilities and pipeline must be operational. As detailed in the project schedule (Figure 6), the construction season is relatively short because activities are limited to the dry season. Construction at any other period would be very difficult because rain saturates

Figure 6

PROJECT SCHEDULE



KNOLLS SOLAR PONDS

the silty and clayey soils, rendering them essentially unworkable.

4. Reclamation

Reclamation of impacts incurred during construction of the KSEPS would be implemented under the direction of the BLM's authorized officer, using guidelines presented in the Reclamation Recommendations in Appendix A. Basic features would include stockpiling and replacement of topsoil, regrading, revegetation, and runoff and erosion control measures. The goal of reclamation would be to return the disturbed areas to a pre-disturbance condition. This would involve borrow areas, disturbance associated with construction of dikes and access roads and any facilities built for construction operations. When operation of the KSEPS ceases, a site-specific plan for reclaiming the entire project area would be required by the BLM.

Visual impact to public roads and highways would be minimized, primarily through dust control measures. The buildings that would be utilized throughout the life of the project should be designed in a manner that would minimize impacts to the visual resources. Building color and form should blend in with the surrounding terrain. Waste materials, debris, and construction equipment and facilities would be removed as necessary, but at least at the completion of construction activities. Safety measures would be taken to minimize the risk of fire, explosion, or hazardous material (i.e. diesel fuel) spills. Any blasting operations would follow Occupational Safety and Health Administration regulations.

A clearance for cultural and archaeological resources would be performed by a contractor approved by the BLM prior to construction. Emphasis should be placed on all sand dunes within the area that would be disturbed, borrow areas in the Grayback Hills and the pipeline route in the vicinity of the Lakeside Mountains. If any cultural or archaeological artifacts are unearthed during excavation or construction, they would be preserved and immediately reported to the BLM. Activities would cease until authorized by the BLM to continue.

Prior to construction activities, a ferruginous hawk nesting survey would be conducted in potential nesting habitat in the Grayback Hills. If any active nests are found within one half mile of mining activities, an alternative borrow site would be used until the end of the nesting season.

During pronghorn antelope fawning season (May 15-June 14), traffic would be restricted to established roadways. To minimize poaching by construction personnel, workers would not be allowed to carry firearms at the job site and a surveillance by the local conservation officer would be increased.

5. Efficacy of Proposed Action

The initial estimate of brine production in 1988 at the beginning of the pond system is 60 million gallons of brine with a magnesium concentration of 7 percent, increasing to 172 million gallons in 1989. The following two evaporative seasons would produce 195 and 202 million gallons with a magnesium concentration of 8 percent. These figures are based on four assumptions: 1) the dikes and canals for the KSEPS would be completed in time to fill ponds before the 1988 evaporative season, 2) annual precipitation of 8.33 inches, 3) 60 inches fresh water pan evaporation, and 4) 200% of normal in-flow into the Great Salt Lake which is then used to predict West Pond brine concentration.

The key to successful operation of the KSEPS is the need for the WDPP to continue. When the elevation of the Great Salt Lake is below 4208, pumping would cease and West Pond brine would not be available to the KSEPS. At this point, the KSEPS can continue to be a brine source for the AMAX magnesium plant for about an additional 15 years through the use of stored brine (post-pumping operations).

To better assess the life expectancy of the KSEPS, three lake level scenarios were developed by AMAX based on the modelling efforts of James (1986) and with the assumption that the WDPP would decrease the elevation of the Great Salt Lake by 1 foot in each year after 1989. A wet, dry, and base case scenario were calculated (Table 2) to cover the spectrum of possibilities that may occur to the elevation of the Great Salt Lake. The base case is the most likely scenario and represents an average between the wet and dry cases. It predicts that the Great Salt Lake will not drop to 4208 until 1994. Under this scenario, the KSEPS would provide brine to the AMAX magnesium plant for 6 years during steady-state operations and an additional 15 years during the post-pumping phase. The dry case scenario would allow for 4 years of production at the AMAX magnesium plant during steady-state operations. With the additional 15 years of production using stored brines, the life of KSEPS as a brine source for the plant under the dry case scenario would be 19 years. Under the wet case scenario, the Great Salt Lake would not drop below 4208 until early in the 21st century and the KSEPS would provide brine for at least 30 years.

The WDPP could resume whenever the Great Salt Lake rose above 4208, allowing operation of the KSEPS to also recommence. If the Great Salt Lake were to remain at levels below 4208, operation of AMAX's Stansbury Basin operations could be reestablished, since costs would be substantially reduced at lower lake elevations.

In summary, using the most conservative estimate, the dry case

Table 2. Estimated elevation (in feet) of the Great Salt Lake under the wet, dry, and base case lake level scenarios[1].

Year	Wet Scenario	Base Case Scenario	Dry Scenario
1986	4211.8	4211.8	4211.8
1987	4214.6	4213.3	4212.5
1988	4214.7	4213.7	4210.5
1989	4215.5	4212.6	4209.5
1990	4215.8	4212.0	4208.2
1991	4215.5	4211.3	4206.8
1992	4215.2	4210.3	4204.1
1993	4214.8	4209.3	4202.6
1994	4214.3	4208.3	4201.3
1995	4213.8	4207.3	4196.8

[1]Estimates are based on James (1986). Lake levels in 1989 and beyond reflect elevations that would be produced as a result of the West Desert Pumping Project (1 foot decrease in elevation).

scenario,the KSEPS would be capable of providing brine for a minimum of 19 years of production. This conservative scenario would also allow for the restoration of the Stansbury Basin system and a return to standard AMAX operations.

Alternative Methods of Acquisition

This alternative would consist of the same construction and operational procedures as the Proposed Action, but would not involve the permitting procedure required for action on federal land. Instead, the lands in question would either be exchanged or sold. Either of these actions would require an amendment to the BLM's Tooele Management Framework which governs the public lands that would be disposed. No long term reclamation plan would be required.

1. Exchange

This method of acquisition would involve an exchange of land in which AMAX would ultimately acquire use of the land. The authority for this action comes from Section 206 of the Federal Land Policy and Management Act of 1976 (43 USC 1716; 90 Stat. 2756).

2. Sale

This method of acquisition would involve a sale of BLM land to AMAX. The authority for this action comes from Section 206 of the Federal Land Policy and Management Act of 1976 (43 USC 1713; 90 Stat. 2750).

No Action

The No Action alternative would result from a denial of the right-of-way grant for use of federal lands.

Alternatives Considered but Eliminated From Detailed Study

1. New Site Development

Two alternative sites with suitable soil, topography, and proximity to the AMAX magnesium plant, were analyzed for development of evaporation ponds. A site in Skull Valley was eliminated from further consideration because the area contains a number of springs which would have required extensive water rerouting to prevent fresh water from seeping into pond areas. In addition, much of the potential area is privately owned and acquisition of these lands may have proved difficult. A second site located south of the Southern Pacific railroad between Lakeside and the Hogup Mountains was also analyzed. Extensive diking would be needed to overcome topographic problems, prevent any potential breaching from the Great Salt Lake, and to reroute discharge from the WDPP. This alternative was eliminated due to the threat of future rises of the Great

Salt Lake and prohibitive costs.

2. Restoration of Stansbury Basin

Reconstructing the Stansbury Basin system has been carefully evaluated. While portions of this area could potentially be used for salt and other mineral production, the entire area would have to be resurrected in order to establish a productive magnesium operation. This procedure would be slow, taking approximately 6 years to produce enough brine to support the Rowley plant. The cost of restoring the magnesium operation would be in excess of $50 million. Once this was accomplished, there would be no guarantee that the North Dike would not be breached again. For these reasons, this alternative was eliminated from further consideration but would be considered if, and when, the lake recedes below 4208.

3. Brine Purchase

The possibility of purchasing brine from existing chemical processing plants was considered as a short term alternative to a permanent solar pond system. This brine would be purchased from companies that produce sodium chloride and potassium chloride. Since these companies do not produce magnesium chloride brines as primary products, but rather as a by-product, the long term (greater than 3-4 years) continuity of supply would not be guaranteed since AMAX does not have control of their feedstocks.

Scoping Summary

A scoping document was distributed to approximately 240 concerned groups, agencies, and individuals. In addition, the general public was alerted to the availability of the document through a media campaign. Eighteen comments were received during the scoping period. Seven respondents either favored the project on economic grounds, or felt that the project would have no impact on their particular area of concern. Important issues raised during scoping were: 1) changes in groundwater chemistry and flow produced by KSEPS, 2) the impact of KSEPS on air quality, both from increased dust and changes in humidity, 3) concern over changes in the visual resource, 4) impacts on the Utah Test and Training Range and 5) the impact of KSEPS on pronghorn antelope utilizing the general area.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

The following description is based on a field reconnaissance conducted in November 1986, pertinent literature, and communication with agency officials. As discussed in the previous sections, the KSEPS cannot function without the WDPP. Although the WDPP will not begin operations until March 1987, this EA is based on the assumption that the WDPP is in place, and as such, its impacts have occurred. This is necessary in order to assess the impacts of KSEPS in relation to the affected environment that will exist when the project commences.

Physical Resources

Groundwater

Groundwater in the vicinity of the proposed project occurs within a deep stratified aquifer in unconsolidated valley fill and a shallow brine aquifer near the surface of the valley fill. This valley fill consists of 100 to 300 feet of fine-grained deposits near the surface and several hundred feet of deeper alternating layers of coarse and fine-grained deposits (Lines 1979). Neither aquifer that occurs within the valley fill contains potable water, since total dissolved solids concentrations often exceed 100,000 milligrams per liter (Nolan 1927).

The aquifer of primary importance to this assessment is the shallow brine aquifer since it is most likely to be impacted by seepage from the proposed AMAX ponds. This aquifer exists within the upper 10 to 25 feet of the valley fill and is considered an aquifer only because of the presence of caliche layers, salt crusts, oolitic sands, and desiccation cracks that increase the permeability relative to the underlying clays (Turk 1973, Turk et al. 1973, Lines 1979, Dames & Moore 1985).

The static groundwater level throughout most of the west desert is within two feet of the ground surface (except where sand dunes and alluvial fans encroach on the valley bottom, resulting in a greater depth to water). The slope of the water table generally follows that of the land surface, with gradients normally being less than one foot per mile (Lines 1979, Dames & Moore 1985).

Surface Water

Water resources in the project area are generally described in the West Desert Pumping Project EIS (USDI 1986). The majority of precipitation reaching the soil surface within the vicinity of the proposed project evaporates, infiltrates, or is held briefly as soil moisture. Water may pond on the salt and mud flats during the winter and spring months when evaporation rates are low. Alluvial fans may be subject to high energy stream flows which occur in response to thunderstorms. No perennial or intermittent streams occur within the affected environment of the proposed project. The major surface water features in the general vicinity of the proposed project include the Great Salt Lake, West Pond, and evaporation ponds near Wendover, Utah.

Mineral Resources

The only potential mineral resource in the proposed pond area is the gypsum found in the sand dunes scattered within the mudflats. All such sites within the project area, specifically around the proposed ponds, are covered by mining claims for gypsum. The Grayback hills are a source of granular material and metals.

No oil or gas leases occur in the affected area.

Soils

The following description of soils that occur within the affected environment of the proposed project is based on on-the-ground field inspection as well as on Wilson et al (1975). Soils in the area of the proposed project are poorly developed, and have formed under an arid moisture regime, are generally alkaline, and have low organic matter content. Five different general soil types or associations, which are described more technically in Wilson et al (1975), occur within the project area. These types are soils occurring on playas, sand dunes, valley bottoms, alluvial terraces and fans, and ridgelines and mountains. No prime or unique farmlands, or farmlands of local or state importance occur in the vicinity of the proposed project.

The major inlet canal, the smaller canals associated with the Pond 7 series, evaporation ponds and associated dikes, pump stations, reservoir, and approximately 3,150,000 cubic yards of borrow would be located on playas. Little or no soil development has occurred on playas due to the relatively young age of the deposits, the highly saline nature of the material, and little or no vegetation growing on the materials. The predominant texture is clay. The landform is level and flat. Infiltration capacities are so slow that water often ponds on the surface. This water then evaporates, leaving behind its mineral content containing a variety of salts. These deposits are generally very deep. The revegetation potential of these soils is very poor due to the excessively high salt content of the soils, and low precipitation and available soil moisture.

The small canal between Ponds 1 and 2, and location of approximately 785,000 cubic yards of borrow would be constructed on sand dunes distributed on the playas. In addition, most of the project components discussed above would occur adjacent to the sand dunes. The sand dunes vary from well vegetated and stabilized landforms, to unvegetated actively moving dunes. These eolian deposits are deep and consist of fine to medium sand to silty sand. These soils are slightly to moderately alkaline, and are somewhat excessively to excessively drained with very rapid permeability. Runoff is essentially non-existent and erosion hazard is low. Topsoil resources are deep. For this project, topsoil is considered to be the surface soil horizons that are suitable and usable for revegetation purposes. Revegetation potential is estimated to be poor to fair with the major limitation to successful revegetation being low precipitation and minimal available soil moisture. The principal vegetation growing on these soils are greasewood, four-wing saltbush, and shadscale. Several small clay sealed internal drainage basins are distributed in the dunes where water ponds for a period of time during the cooler seasons and after precipitation events and snowmelt.

The 41 mile pipeline would traverse an array of soil types including playas, described above, as well as soils on valley bottoms, soils on alluvial terraces and fans, and soils on ridgelines and mountains.

Soils which occur on valley bottoms are generally deep and consist primarily of silty clay loams. The landform is flat and level to gently sloping (<5 percent). These soils are strongly alkaline and are well to moderately well drained with very slow to moderately slow permeabilities. Runoff is medium to slow with a slight to moderate erosion hazard. The topsoil resources are estimated to be deep. Revegetation potential is estimated to be poor to fair with the major limitation to successful revegetation being the high alkalinity of the soils, and low precipitation and available soil moisture. The principle vegetation growing on these soils are salt tolerant plants such as greasewood and shadscale.

Soils which occur on alluvial terraces and fans are generally deep and consist of silty clay loams to very gravelly clay loams. The landform is generally flat to undulating, with nearly level to moderately sloping (0 to <20 percent). These soils are moderately to strongly alkaline and are moderately well to somewhat excessively drained with slow to rapid permeabilities. Runoff is slow to rapid and erosion hazard is moderate. The topsoil resource is estimated to be deep. Revegetation potential is estimated to be poor to fair with the major limitation being high alkalinity and low precipitation and available soil moisture. The predominant native vegetation on these soils is shadscale and other salt tolerant shrubs.

Soils which occur on ridgelines and mountains are generally shallow and have a high gravel and rock content. The landform is undulating to choppy with abrupt topographic breaks and level to very steep slopes (0 to >60 percent). Typical soil textures are gravelly clay loams to very gravelly sandy loams. These soils are mildly to strongly alkaline and are well to somewhat excessively drained with moderately rapid to rapid permeabilities. Runoff is medium to very rapid and erosion hazard is moderate. Topsoil is shallow, or non-existent, and very gravelly. Revegetation potential is estimated to be poor to fair with high gravel and rock content, shallow topsoil, and high alkalinities being the major limitations. The predominant vegetation on these soils is a mixed desert shrub type described in the vegetation section.

Approximately 2,250,000 cubic yards of granular borrow material would be removed from areas with soils on alluvial terraces and fans as described previously. Access roads would be built primarily on playa and on soils on valley bottoms.

Biological Resources

General Vegetation and Wetlands

The components of the proposed project occur in areas consisting of four general vegetation community or cover types including mixed desert shrub, grassland, greasewood, and mud flat.

The vast majority of the project components would be constructed and operated on mud flats including the major inlet canal, several feed canals, evaporation ponds and associated dikes, pump stations, reservoir, and approximately 3,150,000 cubic yards of borrow. The mud flat type is generally devoid of vegetation due to the high salt content. Small greasewood shrubs and iodine bush may be very sparsely distributed about the surface of the salt and mud flat but at densities usually less than 5 percent.

Most of the evaporation ponds, small canals, and location of approximately 785,000 cubic yards of borrow would occur marginal to or on sand dunes distributed on the mud flats. Vegetation on the dunes is typical of the greasewood type. This type is dominated by greasewood both in height and cover. Shadscale, four-wing saltbush, and other shrubs typical of the mixed desert shrub type also occur in this type in low numbers. Tamarisk is also present within topographic depressions within the dunes. In areas which are adjacent to salt flats or where soil salinities are particularly high, iodine bush may be present. Intershrub areas are generally barren; however, when vegetation is present it often consists of bottlebrush squirreltail and Indian ricegrass. Total vegetal cover ranges from 10 to 30 percent.

The 41 mile pipeline would traverse an array of vegetation types including mudflats, greasewood, mixed desert shrub, and grassland. The greasewood that the pipeline would traverse occurs on relatively flat areas with deep alkaline soils rather than on sand dunes as described previously. Vegetal cover ranges from 20 to 50 percent.

The mixed desert shrub type occurs on soils which are shallow to deep with a high gravel and cobble content. This type is dominated by a sparse shrub layer of low to intermediate height consisting of shadscale, budsage, spiney and spineless horsebrush, spiny hopsage, black sagebrush, winterfat, Mormon tea, and little rabbitbrush. Greasewood may also be present where soils are deeper and have a high salt and clay content. Several weedy exotic plant species, including Russian thistle and halogeton, are also evident near previously disturbed areas. The intershrub areas include various forbs and grasses such as Indian ricegrass, bottlebrush squirreltail, cheatgrass, Salina wildrye, alkali sacaton, galleta, Hood's phlox, fleabane daisy, and common peppergrass. Total vegetal cover ranges from 30 to 60 percent.

The grassland type is dominated by cheatgrass which is a weedy exotic species. This plant has replaced the original native bunchgrass vegetation and forms a complete monoculture in many places. Some native grasses such as bottlebrush squirreltail, Indian ricegrass, and needle-and-thread, may also be present in low densities. A very sparse shrub component may occur in this type and includes greasewood, shadscale, rabbitbrush, and big sagebrush. Other grasses and forbs typical of the mixed desert shrub type previously described may also be present within this type. Weedy exotic plants such as halogeton and Russian thistle are also present near roads and other areas of disturbance. Total vegetal cover typically ranges from 70 to 100 percent.

Vegetation at the proposed and alternative borrow sites on the Grayback Hills consists of mixed desert shrub. Access roads would occur primarily on mud flats, but also on areas covered with greasewood and mixed desert shrub.

No wetlands occur in the vicinity of the proposed project.

Plant Species of Special Concern

No federally listed or candidate species, or species of special concern are known to occur in the vicinity of the proposed project (England 1987).

Wildlife

Few important habitat types occur within the area proposed for the construction of the KSEPS, and consequently wildlife diversity is limited. The majority of the pond system and associated components would be constructed on mud flats with a very sparse vegetation cover of greasewood and iodine bush. These mud flats are basically unproductive, and are not considered important wildlife habitat (John 1987). Sand dunes in the project area are dominated by greasewood and desert shrubs which provide habitat for such species as the side-blotched lizard, gopher snake, horned lark, Brewer's sparrow, black-throated sparrow, Townsend ground squirrel, Ord's kangaroo rat and black-tailed jackrabbit. These species make up the prey base for foraging avian and terrestrial predators including golden eagles, red-tailed hawks, prairie falcons, and coyotes.

The brine transfer pipeline would traverse approximately 41 miles of a mixture of greasewood shrub, mixed desert shrub and grasslands. Typical wildlife species would be similar to those described above. Additionally, the proposed pipeline would pass through the southern end of the Puddle Valley Antelope Herd Unit. This herd contains more than 150 animals (USDI 1983) Annual aerial surveys indicate the population is steadily increasing (Worthen 1987).

Typical wildlife species occurring within the vicinity of the borrow sites in the Grayback Hills include horned larks, black-eyed juncos, rock wrens, Brewer's sparrow, chukars, ground squirrels and other small rodents, black-tailed jackrabbits, desert cottontails, badgers, coyotes and pronghorn antelope. Pronghorn occur in the vicinity of the borrow sites, particularly the northern sites and proposed access roads, on the flat or hilly areas adjacent to the Grayback Hills. Pronghorn belong to the Puddle Valley Herd Unit whose range extends from the U.S. Pollution Control Inc. (USPCI) access road, approximately two miles west of the Grayback Hills, east to the Lakeside Mountains. The flat to rolling terrain is used as foraging, fawning and wintering areas. Raptor nesting habitat is available in the Grayback Hills, especially on the steep limestone cliff faces. Potential nesting raptors include golden eagles, prairie falcons and red-tailed hawks. At present no nests have been identified at these borrow sites.

Wildlife Species of Special Concern

No federally listed species are known to reside within the immediate vicinity of the project area (Benton 1987). Transient bald eagles may occur briefly in the area of the Grayback Hills during migration to and from wintering areas in Rush Valley. Peregrine falcons may also occur in this area as rare migrants.

Federal candidate species potentially occurring within the area of concern include the ferruginous hawk and snowy plover. Ferruginous hawks may nest on small knolls throughout the rolling terrain of desert scrub habitat, particularly within the vicinity of the borrow sites and associated access roads at the northern end of the Grayback Hills. Snowy plovers nest on sand flats and utilize alkali ponds for feeding. At present no nests of either species are known to occur within the project area.

Grazing

There are no BLM grazing allotments in the area of the proposed evaporation ponds. However, four grazing allotments occur along the proposed pipeline route. These are the West Grassy allotment which contains 1633 sheep AUMs, the East Grassy allotment containing 1108 sheep AUMs, the Skunk Ridge allotment containing 5340 cattle AUMS, and the Lakeside allotment containing 2390 cattle AUMS. A portion of the borrow site in the south Grayback Hills is within the West Grassy allotment.

Human Resources

Visual Resources

The site is bounded on the south by I-80, a heavily traveled route, making the sensitivity level high. Motorists on I-80 are in an observer normal position with respect to the proposed site with the exception of the Knolls interchange where the observer would be in a superior position. Views from I-80 of the proposed project would cross the foreground, middleground, and background elements of the viewshed.

The site is relatively flat. Mudflats dominate the foreground, while the middleground and background are dominated by three roughly parallel northeast to southwest trending dune complexes. The dunes vary in height from 5 to 15 feet and are visible elements that contrast with the mudflats. However, mirages are common and visual perceptions can be distorted.

The dunes are separated by mudflats which are subtly mottled. The visual edge between dunes and mudflats is a dominant landscape element. Mud flat vegetation includes iodine bush and greasewood. Sand dune vegetation includes shadscale, saltbush, rabbitbrush, greasewood, horsebrush and Indian ricegrass. Predominant vegetation colors are gray, gray-green and buff brown. Soil colors are sand, tan and gray. Overall visual texture is fine to moderate. Ponded water is a natural feature of this landscape in certain locations within the dune complex during certain times of year.

Bureau of Land Management landscape architects have classified the affected environment as a management class 4 "any contrast attracts attention and is a dominant feature of the landscape in terms of scale but it should repeat the form, line, color and texture of the characteristic landscape" (USDI 1978).

The proposed pipeline (41 miles in length) would run parallel to and immediately north of I-80 for a distance of 32 miles. The final 9 miles would trend in a northwest direction diagonal to I-80. Over 85 per cent of the proposed route would be in the foreground of the viewshed from I-80, a highly sensitive zone. Motorists on I-80 would be in an observer normal or superior position relative to the pipeline for most of the route.

Topography along the route is generally rolling, with steeper grades related to the Grayback Hills, Grassy Mountains and Lakeside Mountains. Grades associated with these hills and mountains are tilted toward motorists on I-80.

Vegetation along the proposed route is mostly the shrub/grassland type. Cheatgrass is the predominant species forming a monoculture in some locations. Shrub species of visual importance include rabbitbrush, sagebrush, greasewood and shadscale. Gray and gray-green are the predominant vegetation colors. However, major phenological changes occur in the spring and fall when the colors purple and tan, respectively, become dominant. Soil colors are in the gray to gray-brown range. The landscape traversed by the pipeline has been classified as class 4 in the BLM VRM rating system.

For travelers eastbound on I-80 from Wendover to Salt Lake City, the Grayback Hills are the first significant land forms on the north side of I-80 after leaving Wendover. They are of some visual prominence as foreground and middleground elements of the I-80 viewshed.

Dominant vegetation on the Grayback Hills is of the shrub/grass type. Predominant species include shadscale, horsebrush and cheatgrass. Phenological changes in color from gray green to ocher are pronounced from spring to fall. Soil color is gray brown. Rock outcroppings along the ridgeline are a dominant visual element. The proposed borrow site (Borrow Site

4) has a southwest aspect sloping toward I-80. The Utah Department of Transportation maintains a borrow site to the east of this site; this disturbance is visible from the highway. The Grayback Hills have been placed in VRM class 4 by BLM landscape architects.

There are three proposed borrow sites (Borrow Site 1, 2, 3) on the northern end of the Grayback Hills, approximately 6-9 miles north of I-80. Dominant vegetation in the area includes cheatgrass, greasewood, and rabbitbrush. The sites are bounded on the east side by steep topography. Phenological changes in color and the visual dominance of rock outcroppings are similar to those described for Borrow Site 4. The BLM-VRM plan shows the area as a class 4 zone.

Air Quality

The affected area generally has good visibility and air quality. Considerable dust is generated by traffic on the county road and USPCI access road whenever they are used. Activities at the Utah Test and Training Range (U.S. Air Force), as well as occasional wind storms also increase particulate matter in the air, but in all cases, it is readily dispersed due to the open topography of the area.

The amount of surface water in the Great Salt Lake Basin has a direct impact on the number of days of significant fog and low clouds in the area. These conditions are defined as six hours or more of fog or clouds, creating visibility less than three miles and/or ceilings less than 3000 feet (USDI 1986).

Cultural Resources

Humans have occupied the general area since the Paleo-Indian Lithic Stage approximately 10,000 years ago. Cultural adaptations ranged from subsistence hunting/gathering to a more sedentary life based on the resources of the lake periphery (Madsen 1980). A synopsis of prehistoric and historic utilization of the Great Salt Lake area is presented in the West Desert Pumping Project EIS (1986).

Archaeological sites within the west desert are generally situated above the floor of the Great Salt Desert. These include habitation sites located within cliffs, rock shelters or alcoves; kill-butchering sites; and rock art sites and quarries. At present no sites have been identified within the area of concern. However, this area has not been completely surveyed and the potential exists for the occurrence of sites or finds on the sand dunes located within or adjacent to the proposed evaporation pond complex and borrow sites within the Grayback Hills (Dodge 1987, Madsen 1987).

James and Singer (1980) have developed an archaeological sensitivity map for the general area based on the location of known sites. Sensitivity classes correspond to the probability of occurrence of undiscovered sites and are divided into high, medium, and low probability categories. The entire project area has been classified as a low sensitivity area, with the exception of the Lakeside Mountains which is classified as a medium sensitivity area. This latter area would be skirted by the proposed pipeline that would deliver magnesium brine to the AMAX plant at Rowley, Utah. The classification of the project area as low sensitivity may not be indicative of the potential number of sites, but the result of the lack of surveys within this area (USDI 1986).

Historical resources in the general area include the routes discovered and used by the early explorers and emigrants, as well as any artifacts that they have left behind. Of particular note is the Hastings Cutoff used by the ill-fated Donner-Reed party of 1846. This route is on the Utah State Register of Historic Places.

Another historical site within the general area of concern is the GAPA Launch Site, which is listed on the National Register of Historic Places. This site was one of the first rocket test facilities in the United States. Scattered artifacts exist within this locale. The GAPA site is located approximately two miles east of Pond 3 and one and one-half miles northeast of Pond 5. The main access road to the GAPA site from Knolls comes within approximately 0.4 miles of Pond 5.

Economics

Several firms have been extracting minerals from the Great Salt Lake and are dependent on the stability of lake water levels which have, until recently, been very stable. AMAX Magnesium Corporation, Great Salt Lake Minerals and Chemicals Corporation, American Salt Company, Morton Salt Company, Domtar Industries, Lake Crystal Salt Company, and Solar Resources have all depended on the Great Salt Lake as a source for their extraction activities to produce magnesium, magnesium compounds, potassium chloride and salt. Kaiser Chemical Incorporated produces potash in the west desert further west of the main shoreline using a system of ditches and canals to develop the brine.

In 1983, total sales for the mineral industry in this shoreline area of the Great Salt Lake was over $148.5 million and employment exceeded 1260 persons (UBEBR 1984). At this point, Utah ranked second nationally in the production of potassium salts and magnesium metals, with exports of magnesium metals being approximately 40 percent of production. AMAX had the second largest production plant and the largest lake brine operation. Production of magnesium metal increased from a 30,000-32,000 ton annual output to a peak production of 35,000 tons in 1983 (U.S. Bureau of Mines 1984, 1985). Employment at AMAX increased to a peak of over 750 by 1985. Mineral production royalties paid to the State of Utah averaged over $616,000 for the period 1980-1984 and reached $950,000 in 1983 just at the time the high water problem was building up. AMAX, the largest employer of the industries located in the area, averaged over $136,800 in production royalty payments to the state during this same period, with the peak payment of nearly $200,000 in 1983.

The wet cycle commenced in 1982 and by 1983 several problems were being faced by the major mineral producers in the area. High water, reduced salinity, and low evaporation potential resulted in the abandoning of the Lake Crystal Salt operation. Low evaporation and wet conditions resulted in the shut down of Kaiser Chemical potash operations in the west desert for about a year. Other operations, including AMAX, have attempted to maintain production but their operations have deteriorated considerably because of the recent washout of dikes. During the 1983-84 period AMAX, Morton Salt and Great Salt Lake Salt raised their dikes.

Currently, AMAX does not have the use of the Stansbury Basin evaporation pond system. Some purchase of brine on a short term basis to maintain the viability of the magnesium division has been made, but brine purchase is not an economical long term alternative to the solar pond system on which the division has based their production capabilities. Magnesium chloride brine is no longer produced as a primary product by other industries in the area and can only be obtained as a by-product from operations whose chief brine products are sodium or potassium based. Long term continuity of supply of such a by-product cannot be guaranteed.

Employment at AMAX is now reduced to less than 460 persons. Production royalty payments to the State of Utah have been reduced from a peak of approximately $200,000 in 1983 to $19,767 paid in 1986. AMAX currently pays approximately $3.6 million in state taxes and over $900,000 in property taxes to Tooele County.

Land Use

The BLM lands within the affected area are regulated by the Tooele Management Framework Plan (MFP). The most predominant land uses are livestock grazing and wildlife habitat with some mineral development, recreation, and rights-of-way uses also occurring (USDI 1984). The lands are within oil and gas category 1 which is leasing with standard stipulations. The proposed ponds and associated facilities are within an undesignated area; sale or exchange of these lands would require an amendment to the MFP. A portion of the lands along the pipeline route are designated for federal retention. The lands surrounding the pipeline where it follows the Rowley road are designated for disposal/management for specific purposes. There are no existing or proposed Wilderness Study Areas in the affected environment.

Utah Test and Training Range

The North Range of the Utah Test and Training Range (UTTR) is located north of the project area and the South Rang to the south of I-80. The ranges are managed by the Air Force Systems Command of the U.S. Air Force. The UTTR functions as a testing facility for new equipment and programs and as a training area for Air Force and other governmental agency personnel. Activities in the vicinity of the KSEPS primarily involve overflights of aircraft and tactical target practice. Operations at the UTTR are directly effected by weather, primarily in terms of horizontal visibility and cloud cover height. Flights over large water bodies are restricted to a minimum altitude of 1000 feet.

ENVIRONMENTAL CONSEQUENCES

Proposed Action

Physical Resources

Groundwater

No impacts to groundwater quality are anticipated as a result of the proposed action, due to the naturally high salinity of groundwater in the shallow brine aquifer underlying the proposed ponds. Therefore, impacts to groundwater resulting from the proposed action would be due primarily to a rise in the water table in the vicinity of the ponds. This rise would occur due to leakage from the ponds into the surrounding sediments.

To determine the magnitude of potential water level rises, White (1987) modeled the shallow brine aquifer in the vicinity of the proposed action under both the steady-state and post-pumping scenarios. Local groundwater data required for the modeling effort were obtained primarily from Dames & Moore (1986), USPCI (1984), and the U.S. Department of Energy (1984). The steady-state scenario was modeled considering the cumulative impacts of the KSEPS and the West Pond.

Critical facilities of concern in the vicinity of the proposed action include the USPCI hazardous-waste disposal facility located in Section 16, T. 1

N., R. 12 W. (within one mile northeast of Pond 5 of the post-pumping scenario), the Vitro tailings disposal site located in Section 32, T. 1 S., R. 11 W. (approximately seven miles southeast of the proposed ponds), and the Western Pacific railroad tracks and Interstate Highway 80, both located within one mile south of the proposed ponds. The post-pumping scenario was modeled with the assumption that the evaporation ponds would dry up after three years of operation with brine remaining in Pond 5, the Pond 7 series and the reservoir. The base-case scenario described in the Proposed Action was used to determine years of operation of the KSEPS.

After approximately six years of operation under the steady-state scenario, the relatively steep hydraulic gradient of the water table along the edge of the sand dunes that form the eastern boundary of Pond 5 are expected to prevent the water level in the shallow brine aquifer from rising at the USPCI facility (White 1987). Approximately 6 years after beginning the post-pumping scenario, water levels in the shallow brine aquifer are expected to rise less than 0.1 feet beneath the USPCI facility (White 1987). The primary source of this water level rise would be Pond 5. This change in groundwater levels beneath the USPCI facility would not be considered a significant impact.

No impacts to the elevation of the water table are anticipated in the vicinity of the Vitro tailings site under either the steady-state or post-pumping scenario (White 1987). However, water levels would rise locally along the highway and the railroad tracks adjacent to the proposed ponds during the steady-state scenario and the initial portions of the post-pumping period. Since this rise would also occur as a result of the adjacent WDPP, the effect of the KSEPS would be to extend the zone of water level rise to the east. Although this rise may affect the stability of the road and track, this effect is expected to be minimal since these facilities were designed for poor foundation conditions.

If the pipeline between the ponds and the AMAX processing plant ruptures, local increases in the elevation of the water table would occur. However, these increases would be minor due to the expected short-term nature of such a rupture. Rupturing would not impact groundwater quality due to the high natural salinity of groundwater in the shallow brine aquifer.

Surface Water

No significant impact to surface water drainages is expected as a result of implementing the proposed project provided that hydraulic continuity is maintained wherever small drainages are crossed or disturbed. Withdrawal of water from the West Pond would not significantly alter the water level of the pond or the operation of the WDPP since only a small percentage of the water pumped into the West Pond would be used by AMAX. Extraction of magnesium salts proposed at the KSEPS and subsequent transfer of the minerals out of the Great Salt Lake Basin would not significantly deplete the total quantity of these salts in the basin. The amount of mineral deposition over the life of the project is estimated to be 100 million tons which is essentially the same amount of mineral deposition that had been occurring in the old AMAX pond system at Stansbury Basin. This amount of mineral loss is substantially less than the inflow of magnesium salts into the Great Salt Lake Basin.

Mineral Resources

Most of the land impacted by the KSEPS would be on the mudflats and not in areas where significant mineral resources would exist. However, removal of dune sand for use in dike construction would decrease the amount of gypsum available for mining. The dune areas are presently scattered in the mud flats, hence access to them is very difficult. The KSEPS would not alter this situation significantly. Access to mining claims could be enhanced by development of access roads and roads constructed atop the dikes.

A mining opportunity would be created once AMAX has abandoned the site. Salts would precipitate out of the brine solution covering the bottom of the evaporation ponds and could be harvested following the conclusion of the proposed action.

Removal of borrow from the Grayback Hills would decrease the amount of granular material available for exploitation.

Soils

Construction of the proposed project would result in three basic impacts to soils. These impacts include inundation of soil resources, disturbance of soil resources and subsequent increased erosion and off-site sedimentation, and inability of the disturbed soils to revegetate to pre-disturbance conditions in the short-term. Approximately 27,000 acres of playa would be inundated by the evaporation and storage ponds. Salts would precipitate out as the brine became more concentrated with evaporation. The inundation of this soil type and salt deposition would not be considered significant since the soils are already saturated with salts. The inundation would be equivalent to natural flooding by the Great Salt Lake during relatively short periods of recent geologic time.

The construction of the inlet and feed canals, pumps, most of the diking and access roads, and reservoir would disturb soils and alter the topography of the playas. From a resource standpoint, this disturbance would not be considered significant since these soils do not support significant amounts of vegetation.

Disturbance of sand dunes for dike development and facilities construction would result in the removal of protective vegetation and the disturbance of soil resources which may subsequently result in increased wind and water erosion, as well as a loss in the ability of the site to support native vegetation that is useful to wildlife. This disturbance would occur on soils with poor to fair revegetation potential. These areas may be difficult to stabilize in terms of minimizing surface runoff, erosion, and offsite sedimentation. Exotic plant species such as cheatgrass, Russian thistle, and halogeton may become established at the expense of more desireable plant species. These impacts would not be considered significant since a reclamation and revegetation plan would be implemented to revegetate the site as soon as possible after construction.

Assuming a 75-foot wide construction zone along the proposed pipeline route, approximately 65 acres of playa, 216 acres of soils on valley bottoms, 87 acres of soils on alluvial terraces and fans, and 5 acres of soils on ridgelines and mountains would be denuded of vegetation and disturbed. Approximately 400 acres of soils on alluvial terraces and fans would be disturbed due to extraction of granular borrow materials at the proposed sites. It is assumed that an equivalent amount of disturbance would occur if the alternative sites were exploited. The resulting impacts would be similar to those previously described for vegetated soils.

An unknown quantity of soils on valley bottoms and on alluvial terraces and fans would be disturbed due to road construction. The quantity is expected to be small and not significant since disturbed would be reclaimed.

No prime or unique farmlands, or farmlands of state and local importance would be impacted by the construction of the proposed project.

Biological Resources

General Vegetation and Wetlands

Construction of the proposed project would result in the destruction and disturbance of vegetation due to inundation and project component construction. The loss of the vegetation would be considered a long-term impact since it would take on the order of 30 years or more to revegetate to pre-disturbance conditions. The loss of vegetation due to the inundation of approximately 27,000 acres of mud flats would continue throughout the duration of project operation and beyond. The revegetation potential of mud flats is essentially nonexistent and therefore, revegetation would have to be left up to natural succession. This process would proceed along a natural course similar to what would happen with the natural rise and recession of the Great Salt Lake. Consequently, the loss of vegetation on mud flats would not be considered significant.

Disturbance due to extraction of sand and dike construction would be approximately 100 acres. This impact would not be considered significant since a reclamation and revegetation would be implemented.

Assuming a 75 foot wide construction zone along the proposed pipeline route, approximately 65 acres of mud flat, 141 acres of greasewood, 113 acres of mixed desert shrub, and 53 acres of grassland would be denuded and disturbed due to the construction of the 41 mile pipeline. An unknown quantity of greasewood and mixed desert shrub would be denuded due to road construction. This area would be small and provided successful reclamation occurred, would not be significant. In addition approximately 400 acres of mixed desert shrub would be denuded and disturbed at the proposed borrow sites. This disturbance would not add significantly to the cumulative loss of these types within the west desert area. This impact may be difficult to mitigate in both the short and long-term due to the relatively poor revegetation potential of the affected environment. However, if the revegetation plan is successfully implemented, the impact would not be considered significant.

No wetlands would be impacted by the proposed project.

Plant Species of Special Concern

No impacts would occur to federally listed or candidate species, or state sensitive species since none occur in the vicinity of the proposed project.

Wildlife

Construction of the KSEPS would result in the loss of approximately 27,000 acres of mud flats. Since mud flats are not considered an important wildlife habitat type, loss of this habitat would not be a significant impact. Disturbance of approximately 400 acres of greasewood shrub, mixed desert shrub and grasslands along the pipeline ROW and sand dunes adjacent to the evaporation ponds would reduce the habitat for a number of small mammals and passerines. An additional 400 acres of these habitat types would be lost at the borrow sites in the Grayback Hills. These losses in habitat would not be significant since a reclamation plan would be implemented.

Construction activities would result in the loss or displacement of small mammals and passerines. Losses would not affect overall populations of these species, but may result in a depression of local populations. Because these species have high reproductive rates and are expected to recolonize the area after construction disturbance and successful revegetation, the impact would be considered temporary. Loss or displacement of mammalian and avian prey species would not be expected to impact the carrying capacity of resident or wintering raptors due to raptor's highly mobile character and opportunistic foraging habits.

The magnesium brine pipeline would run adjacent to existing road and rail spur right-of-ways, skirting the southern end of the Puddle Valley Antelope Herd Unit. Because pipeline construction would occur adjacent to existing rights-of-way, no additional disturbance impacts to pronghorn are anticipated. A relatively small amount of forage would be lost along the perimeter of their range.

Construction of access roads and development of a borrow site within the northern Grayback Hills would result in the loss of additional pronghorn forage, but would not significantly affect the distribution or population dynamics of this herd because such a small proportion of available habitat in the immediate area would be affected. Even though construction activities would be designed in a manner that would minimize disturbance or harassment of antelope, the increased access to this area would still result in a minor amount of disturbance to local individuals, particularly during the fawning season of May-June, as well as increase the potential for vehicular-related mortality and poaching.

Borrow site development would affect raptors nesting within one half mile of the construction zone. Continued disturbance could result in nest abandonment and reduced recruitment to local populations. This would not be considered a significant impact since the number of raptors potentially using the area is minimal.

Wildlife Species of Special Concern

Since no federally listed species reside within the area of concern, there would be no impact. An occasional transient bald eagle or peregrine falcon may be disturbed by construction activities, but such disturbance would only result in the individual moving to a resting perch beyond the influence of construction activities.

Since a pre-construction nesting survey would be required, no impacts to ferruginous hawks would occur. Since the probability of snowy plovers nesting within the project area is very low, no significant impact is expected.

Grazing

The amount of forage disturbed during construction of the pipeline and excavation activities at the south pit of the Grayback Hills would be minimal. This forage loss would be reclaimed. Therefore, the impact to the four grazing allotments would not be significant.

Human Resources

Visual Resources

The small irregular pattern of existing vegetation and mudflats would be obliterated by waters brought to the site through the inlet canal. The dunes would appear as islands, the shoreline artificial in locations where sands must be pushed up for diking.

The geometric dikes and canals associated with Pond 4, the Pond 7 series, and the reservoir would be foreign to the existing edge condition between dunes and mudflats. These contrasting lines and forms would be highly visible as foreground elements from I-80, particularly from the Knolls interchange.

Pump station buildings and other facilities associated with the solar ponds would produce additional visual impacts. However, since they will be designed in a manner that would blend in with surrounding landscape, these impacts would be reduced. Harvesting equipment and pumps would remain as visual contrasts.

The magnitude of these changes to the existing visual resource would exceed BLM standards for a class 4 zone. The visual impacts of the KSEPS would add slightly to the cumulative impacts (particularly for westbound motorists) associated with the West Pond.

Trenching activities associated with the construction of the pipeline would involve the removal of shrub-grass vegetation and disturbance of the soil profile. These activities would result in a contrast in line, color and texture with the characteristic landscape. Those sections of pipeline that are tilted toward and higher in elevation than I-80 would be most visible to motorists. The disturbance would be in the foreground of the viewshed and readily apparent. However, contrasts created would not dominate the landscape and would be in compliance with BLM VRM class 4 standards.

Short term visual impacts of concern would include form and color related to trenching and pipe laying equipment. In addition, fugitive dust that is often associated with pipeline construction could produce visual impacts that would exceed class 4 standards and be considered significant, unless dust control measures are implemented.

Borrow material from Borrow Site 4 would be removed primarily between elevations 4,400 and 4,510. These activities would produce a moderate sized elliptical area of contrast in line, form, and texture as viewed from I-80 eastbound motorists in particular). The contrast would not compete for dominance with the backdrop of the Grayback Hills. Consequently, the borrow operations would significant visual impacts but they would be in compliance with BLM VRM standards for a class 4 zone. However, fugitive dust associated with mining and transportation could be a significant visual impact in excess of class 4 standards, unless dust control measures are implemented.

Excavation of borrow from the North Grayback Hills sites (Borrow Site 1, 2, 3) would be visible as a background element from I-80. Borrow Sites 1 and 2 would be less visible from I-80 than Borrow Site 3 since they are approximately 3 miles further from the highway. Because of restricted access to the site, there would be few dispersed area recreationists in the vicinity. However, proximity to Lambert Boulevard would make visual access possible for a limited number of Air Force personnel. Excavation activities would produce visual contrasts in line form color and texture, they would be viewed infrequently and by a limited number of individuals. The proposed extraction activities at any of the three sites would be in compliance with the level of visual impact permitted in a BLM VRM class 4 zone.

In summary, the proposed solar ponds and related equipment would exceed the levels of visual impact allowed in a class 4 zone. They would contribute slightly to the cumulative visual impacts associated with the West Pond. No practical methods of mitigating these visual impacts during the life of the project are known. Visual impacts associated with the pipeline and borrow sites would be minor both in the short and long term and could be minimized if the reclamation procedures outlined for the soil and vegetation resources are implemented.

Air Quality

The creation of fugitive dust from activities associated with mining, hauling, and construction of dikes and roads would increase the amount of particulate matter in the air. This impact would not be considered significant as long as dust control measures, primarily watering of all roadways during construction, are implemented.

The air quality would also be impacted by the increase in surface water created by the evaporation ponds. Based on a total pond area of approximately 27,000 acres and using a factor of 4.15 days of fog per 100,000 acres of surface water (Hill 1985), it is estimated that creation of the KSEPS would produce one additional day of fog each year it was in operation. As the ponds dry up in the post-pumping scenario, the decreasing surface water would add less and less to the additional fog in the area. Only 5647 acres of pond would remain three years after the post-pumping scenario was initiated.

Cultural Resources

A clearance for cultural resources would be conducted in areas having the greatest potential to support artifacts prior to any construction activities. Areas not included in the clearance, primarily the desert floor, are areas of low sensitivity and the probability of sites being inundated is minimal. Therefore, no significant impacts would occur.

Construction and operation of the KSEPS would not effect the GAPA Launch Site or access road.

Economics

The proposed configuration for constructing the KSEPS, including the pipeline to Rowley, calls for a construction period of approximately 15 months. The total cost of construction is estimated to be approximately $16 million. Construction jobs are projected to average 123 over the 15 month horizon with earnings generated in the local economy of approximately $2.3 million. Using an income multiplier of 1.59 recently estimated for new Wasatch Front construction activities (Keith et al. 1985), this level of income means a temporary increase in value added income of approximately $3.7 million initially generated by the construction activity.

Employment, and hence earnings impacts, would actually be experienced at different levels for shorter durations than the 15 month period. The peak construction employment is projected to occur during the initial 5 months of construction which is anticipated to be from June through October of 1987 if right-of-way and permitting agreements are reached. Construction employment is then reduced for the next two months to 100; reduced again to a low of 20 jobs during the third phase of construction for the next 5 months; and then construction jobs are projected to number 100 for the final 3 months.

Operating employment under the new evaporation pond system in combination with the Rowley plant operations is anticipated to rise from the current level of 460 to the pre-breach level of approximately 750 jobs. This would be an additional 50 more jobs than existed at the peak of operations when the Stansbury Basin evaporation pond system was being used. This level of employment would be 340 more jobs than current employment levels which would generate an additional $11.3 million in income. Increased income to the State from this level of earnings would be approximately $18.3 million using the nonferrous metals sector income multiplier (Glover et al. 1981).

Production royalties which would be paid to the state for the use of the

Great Salt Lake brine medium would again reach well over $200,000 annually. Tax payments to Utah from the operations at capacity levels are projected to exceed $4.0 million annually and property taxes to Tooele County will be over $1.0 million. Rental payments to the federal government would be made, but appraisals to establish rental fees have not, as of this writing, been determined. However, it is projected that rental for the right-of-way could exceed $67,000 annually.

Land Use

No significant impacts to land use would occur since the proposed action does not significantly interfere with the predominant land uses (livestock and wildlife habitat) outlined in the Tooele Management Framework Plan. The affected area has not been identified as unsuitable for mineral exploration and would be compatible with existing land uses and resources.

Utah Test and Training Range

The slight increase in fog detailed in the Air Quality section would not result in significant alterations in operations at the UTTR. The surface water associated with the evaporative ponds would likely not require a change in flight paths since the ponds would be broken up by dunes and visual cues would be abundant. The potential for unauthorized personnel gaining access to the range would increase slightly since roads would be improved and the number of people in the area would increase during periods of construction.

Alternative Methods of Acquisition

A number of resources would be lost to public ownership if the lands in question were either sold or exchanged. This would include recreation, wildlife habitat, grazing, and mineral resources. Since it is not known how the future landowner would manage the land, the availability of these resources to the public cannot be predicted.

No Action

With the exception of economic conditions described below, no significant impacts would occur as a result of the No Action alternative.

Economics

The economic impacts of not initiating the KSEPS project consists of employment, income and public revenue effects. AMAX, as a division of a larger extraction and minerals processing corporation (AMAX), would have to find a cost-efficient source of magnesium chloride or dolomite from which the magnesium metal could be produced or the division would have to close. The amount of pond area needed for a productive magnesium chloride brine feedstock is quite large. Approximately 6 years would be required to produce the brine supply if restoration of the Stansbury Basin site was attempted. There is no guarantee that the north dike would not be breached again by rising waters or by wave action during storms in combination with rising water levels in the Great Salt Lake. The costs of restoring this previous brine development site have been estimated to be in the neighborhood of $50 million. Therefore, if the proposed action is not implemented, the Utah division of AMAX would likely relocate out of the state.

Closure of the brining and electrolysis operations would mean a loss in employment of approximately 460 persons. This would result in a projected direct and indirect loss in income of approximately $30 million incident to a complete closure of operations at AMAX.

Production royalties to the State have ceased since the shut down of brine development at the Stansbury Basin site. These royalty payments would be lost for the long term without development of the KSEPS project. Production royalty payments were $107,718 in 1981, $103,919 in 1982, a peak of $199,435 in 1983, then dropped to $136,352 in 1984, dropped again to $118,750 in 1985, and were only $19,767 in 1986. Land rental payments to the State amounting to over $40,000 annually would be lost. Taxes paid to the State in the form of withholding, unemployment, sales, excise and franchise levies in the approximate amount of $3.5 million would be lost for the long term by a complete shutdown of operations.

County property taxes of approximately $1.0 million would also be lost by closure and a pull-out of the entire AMAX operations.

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APPENDIX A

RECLAMATION RECOMMENDATIONS

The following measures are intended to be used for reclamation purposes at the discretion of the authorized officer.

Reclamation Goal

Reclamation and revegetation of sites with more than 5 percent vegetal cover should be implemented to meet the following objectives:

1) stabilize the disturbed areas as soon as possible to minimize soil erosion and off-site sedimentation

2) return the disturbed areas to a pre-disturbance condition.

Site Clearing

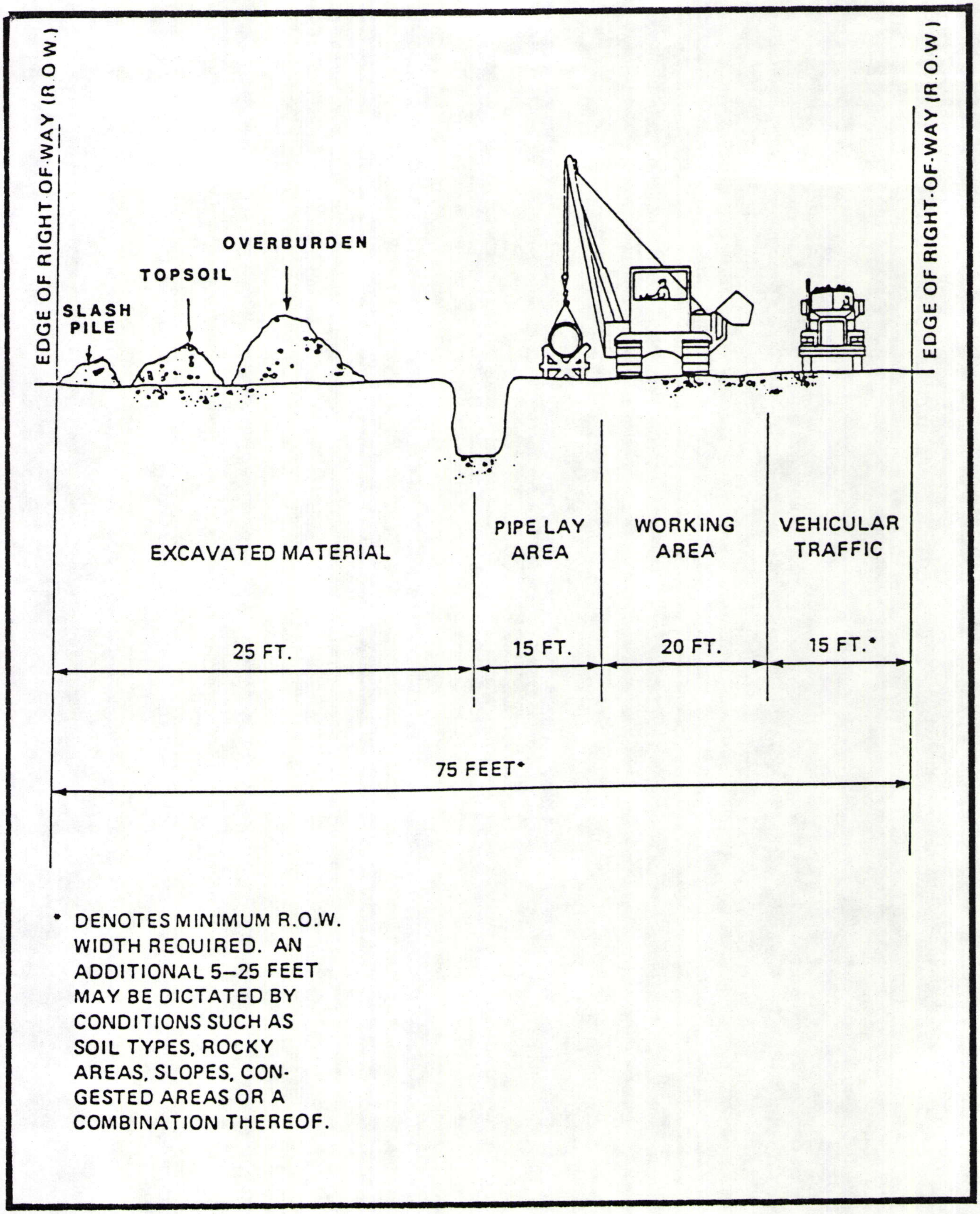
All construction should be accomplished to minimize the cumulative area of disturbance thereby reducing the total area impacted and the area that would require revegetating. In general, where topsoil is not removed, vegetation should be crushed rather than removed. All vegetation cleared along the pipeline corridor should be piled to the side of the ROW for later use in site preparation. Figure 1a indicates the approximate construction plan, and overburden, topsoil, and slash pile locations for the pipeline construction.

Topsoil Removal, Handling, and Storage

The surface soil material should be stripped to a minimum depth of 8 inches from the areas to be disturbed during construction and areas disturbed that would be used throughout the duration of the project. The topsoil should be stock piled in a secure area away from all construction activities and labeled to distinguish it from other earth material piles. Unsuitable materials such as large cobbles and rocks that occur in the stripped topsoil should be separated from the topsoil and backfilled into excavated areas or in the pipeline trench, or disposed of in areas approved by the authorizing officer. Some areas may not have adequate topsoil quantities for successful reclamation. Consequently, at the discretion of the authorized officer, additional topsoil should be removed from areas with excess topsoil and transported to areas with deficient quantities to increase reclamation potential.

Trenching, Overburden Removal, Storage and Replacement

Materials excavated from the pipeline trench should be stockpiled separately from the topsoil within the ROW as indicated in Figure 1a. Following placement of the pipeline in the trench, the trench should be backfilled as described in the CU plan. All disturbed portions of the ROW should be regraded to meet the configuration of the adjacent undisturbed land.



TYPICAL RIGHT-OF-WAY CONFIGURATION

(Source: Kern River Gas Transmission Erosion and Sediment Control Guide)

Figure 1a

Runoff and Erosion Control

The applicant should employ all efforts to minimize disturbance to natural drainage channels. No significant drainage channels or floodplains would be crossed, however, where construction activities cross minor drainage channels construction and reclamation activities should be accomplished in such a way as to maintain the hydraulic integrity of the channel. The pipeline should be buried to a minimum depth of 4 feet below the present bottom of all gullies and drainage channels. Surface runoff and erosion should be controlled on site during and after construction so that a minimum of off-site sedimentation occurs. Runoff control measures such as water bars should be placed on regraded slopes, in general, and specifically along the disturbed pipeline corridor to control and minimize runoff across and down the disturbed areas. The following waterbar spacing guide (Table 1a) should be utilized in determining the spacing of such structures. The need for additional waterbars should be determined by the authorized officer. The water bars should be constructed such that diverted water would be directed and discharged onto undisturbed areas. The waterbars should be constructed with gradients of approximately 1 percent, but no greater than 2 percent perpendicular to slope.

Table 1a. Waterbar spacing guideline (specific guidelines to be determined by the authorized officer).

Slope (%)	Spacing (ft)
5	150
10	100
20	50
30	40
40	30
50	20
60	15
70	10

The time between site clearing and construction, and reclamation should be minimized as this has been found to be very effective in reducing the amount of soil loss due to erosion. Similarly, the duration of time and the distance the pipeline trench is left open should be minimized to reduce the opportunity of significant in-trench water flow in response to a runoff generating precipitation event or snowmelt. In the event that the trench is left open for a long distance down a slope, ditch plugs which consist of small earthen dams within the trench should be used to divert water out of the trench. The need for, and application of, the plugs should be directed by the authorized officer. These structures would minimize the potential for significant concentrations of flow to occur within the trench. Such structures may also

Table 2a. Seed mix prescription for revegetating any disturbed areas with sufficient topsoil quantities to be revegetated at the discretion of the authorized officer.[1]

Species	Cultivar or Variety	Seed Application Rate (PLS lbs/ac)[2]
Grasses		
hicrest wheatgrass		3.0
thickspike wheatgrass	critana	2.5
bottlebrush squirreltail		1.5
Mammoth wildrye	volga	1.5
Sand dropseed		0.25
Forbs		
gooseberry-leaf globemallow		0.5
yellow sweetclover	madrid	0.5
Shrubs		
fourwing saltbush		1.0
prostrate summercypress		0.5
fringed sagebrush		0.02
	TOTAL	11.27

ALTERNATE SPECIES[3]

		Replacement
Grasses		
crested wheatgrass	Ephraim	hicrest wheatgrass
alkali sacaton		any grass
galleta	viva	any grass
Russian wildrye	vinall	Mammoth wildrye
Forbs		
desert marigold		gooseberry leaf globemallow
white evening primrose		same as above
Shrubs		
budsage		fringed sage
shadscale		fourwing saltbush
mat saltbush		fourwing saltbush

[1]-seed mix based on objectives previously listed, species adaptation to the site conditions of the project, usefulness of species for site stabilization and livestock and wildlife use, species success in revegetation efforts, and current seed availability and cost.

[2]-application rates are for drilled seed. If broadcast, these rates should be increased by a factor of 2.5. PLS=pure live seed.

[3]-species that should be used to replace the prescribed species on the event that they are not commercially available in suitable quantities or are too expensive. The substitution will be directed by the authorized officer if deemed necessary.

serve to facilitate the movement of livestock and wildlife across the trench.

Topsoil Replacement and Seedbed Preparation

The areas that will receive topsoil should be ripped by using subsoilers. The stockpiled topsoil should be re-spread evenly over the disturbed area to be revegetated. The re-distributed topsoil should be scarified by disking on the contour if possible to reduce compaction and increase infiltration capacity. In the case of pipeline construction, the previously piled vegetation should be re-spread over the cleared ROW and disked into the topsoil. All topsoil removal, trench excavation, pipeline construction, backfilling, topsoil replacement, and seedbed preparation should be accomplished contemporaneously.

Seeding

The seed mix presented in Table 2a, or an equivalent mix depending on seed availability and as approved by the authorized officer, should be applied using a rangeland drill or a deep furrowing seeder on the contour. The drill should be set to cover seeds with approximately 1/2 inches but not greater than 1 inch of soil. A weighted roller should be pulled behind the seeder to provide a firm seed bed around the seed. The seed mix is designed to provide successful revegetation on all soils and within the mixed desert shrub, grassland, and greasewood (including sand dunes) communities. On some of the steeper slopes or on soils with a high coarse fragment content, seed broadcasting may be required. In such cases the seed mix should be applied at 2.5 times that shown in Table 2a. The broadcast seed should be applied using a rotary spreader mounted on a tractor and covered with soil by pulling a flexible cultipacker or dragging a chain behind the tractor. The seed mix should be planted in late October or early November.

Mulching

Native certified weed-free hay should be applied to the disturbed areas after seeding at a rate of 2 tons per acre at the direction of the authorized officer. The hay should be crimped into the soil surface using a serrated disk crimper.

Monitoring and Maintenance

A monitoring plan should be applied to evaluate reclamation success. Any significant problems encountered during monitoring should be mitigated immediately at the direction of the authorized officer, including areas with revegetation failure or areas with erosion problems